

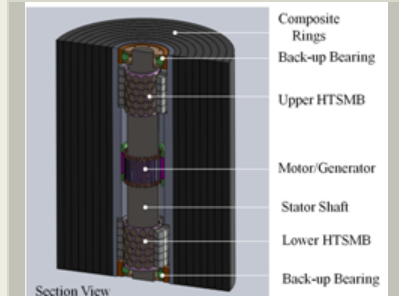
# High Energy Density, High Power Density, High Cycle Life Flywheel Energy Storage Systems, Phase I

Completed Technology Project (2013 - 2013)



## Project Introduction

Balcones Technologies (BT), LLC proposes to leverage technologies developed by and resident in BT, The University of Texas Center for Electromechanics (CEM) and Applied Nanotech Incorporated (ANI) in the areas of carbon nanotube composites (CNT) and terrestrial and space-based flywheel energy storage systems to address SBIR 2012 subtopic S3.04 Power Electronics and Management, and Energy Storage. To provide a near term commercial focus in addition to NASA space applications, BT is augmenting this team with Astral Infinity (AI) to provide one target application that requires flywheel energy storage systems with characteristics that exceed current flywheel systems and exceed lithium battery capabilities – a solar powered high altitude long endurance unmanned air vehicle. This proposal, focuses on making a major near-term advancement in flywheel energy density, with high potential for further longer term advancements, by exploiting ANI carbon nanotube expertise and CEM/BT flywheel technology. After having plateaued for two decades, there is a good probability of attaining near-term improvement of 30%-50% for flywheel rotor specific energy by reinforcing the carbon fiber composite matrix material with CNT. Subsequently, there is a potential improvement in the medium to longer term of an order of magnitude or more by also replacing the current carbon fibers with fibers composed of CNTs. Our program focuses on the near-term objective and is a first and appropriate step in the longer term objective. In particular, for this Phase I project our team will: 1. Develop a concept design for a flywheel rotor that relies on CNT reinforced composite flywheels for a 30%-50% increase in flywheel stored energy per kg to substantially exceed the specific energy performance of chemical batteries (e.g., lithium batteries) for most space-based and terrestrial applications of a few kW-hrs or more, and 2. Complete an initial round of CNT materials testing to support the design.



High Energy Density, High Power Density, High Cycle Life Flywheel Energy Storage Systems

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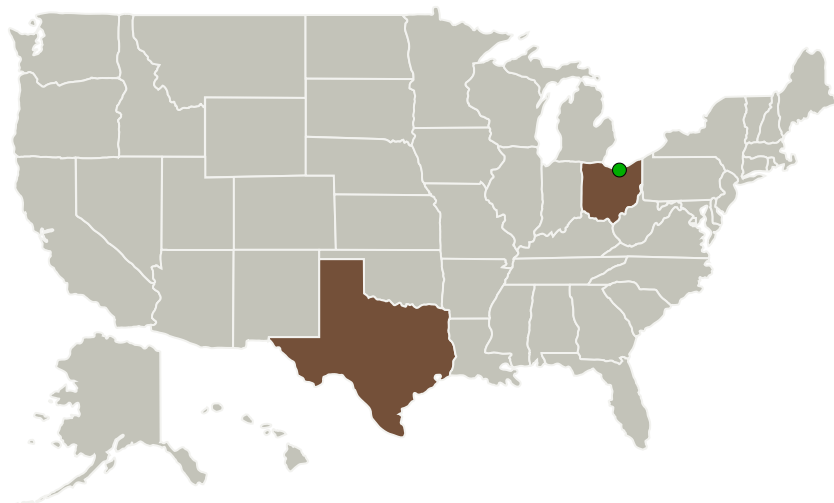
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## Primary U.S. Work Locations and Key Partners



| Organizations Performing Work | Role                    | Type        | Location        |
|-------------------------------|-------------------------|-------------|-----------------|
| Balcones Technologies, LLC    | Lead Organization       | Industry    | Austin, Texas   |
| ● Glenn Research Center(GRC)  | Supporting Organization | NASA Center | Cleveland, Ohio |

### Primary U.S. Work Locations

|      |       |
|------|-------|
| Ohio | Texas |
|------|-------|

## Project Transitions

**May 2013:** Project Start**November 2013:** Closed out

### Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/138198>)

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Organization:

Balcones Technologies, LLC

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

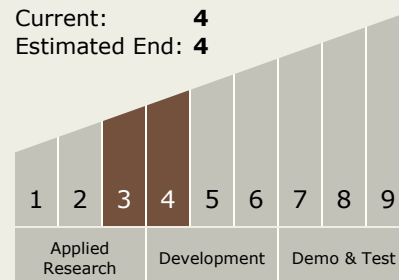
Carlos Torrez

### Principal Investigator:

Richard J Hayes

## Technology Maturity (TRL)

Start: **3**  
 Current: **4**  
 Estimated End: **4**

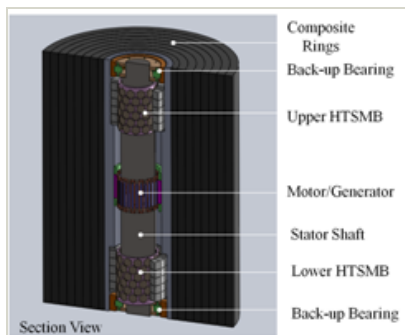


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## Images



### Project Image

High Energy Density, High Power Density, High Cycle Life Flywheel Energy Storage Systems  
(<https://techport.nasa.gov/image/126969>)

## Technology Areas

### Primary:

- TX03 Aerospace Power and Energy Storage
  - └ TX03.2 Energy Storage
    - └ TX03.2.3 Advanced Concepts for Energy Storage

## Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System